REMARKS

Applicants thank the Examiner for the thorough consideration given the present application. Claims 1-8 are pending. Claims 1, 2, 3, and 8 are amended. Claim 1 is independent. The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein.

Allowable Subject Matter

The Examiner states that claims 2-8 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In particular, the Examiner states that the prior art of record does not teach or disclose the claimed control system for a permanent magnet linear motor as recited in claim 3. In response, the above-described limitation of claim 3 is incorporated into independent claim 1. Therefore, independent claim 1, and the claims which depend directly or indirectly therefrom, should be in condition for allowance.

Claim for Priority

The Examiner has recognized Applicants' claim for foreign priority. A certified copy of the priority document will be filed in due course.

Drawings

The drawings are objected to on the grounds that FIG. 1 should be designated by a legend such as "PRIOR ART. Included with the accompanying Letter to the Official

Draftsperson is a proposed change to identify FIG. 1 as "COMPARATIVE ART" and, in anticipation of approval, a revised formal drawing therefor. It is respectfully submitted that the drawings comply with USPTO requirements, and the Examiner is requested to provide Examiner provide a Notice of Draftsperson's Patent Drawing Review, Form PTO-948, confirming approval of the formal drawings by the Official Draftsperson, with the next official communication.

Acknowledgement of Information Disclosure Statement

The Examiner has acknowledged receipt of the Information Disclosure Statement filed December 12, 2001, and has returned an initialed copy of the Form PTO-1449.

Specification Changes

Changes are made to the specification to correct minor typographical errors. No new matter is added.

Rejection under 35 U.S.C. §102(e)

Claim 1 stands rejected under 35 U.S.C. §102(e) as being anticipated by Stuntz et al. (U.S. 6,039,028). This rejection is respectfully traversed.

As noted, the allowable subject matter of claim 3 is incorporated into claim 1. Therefore, claim 1, and the claims depending therefrom, are in condition for allowance. Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. §102(e) are respectfully requested.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and that the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone Carl T. Thomsen (Reg. No. 50,786) at (703) 205-8000.

Pursuant to 37 C.F.R. §§1.17 and 1.136(a), Applicants respectfully petition for a one-month extension of time in which to file this reply. A check for $55 is attached.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly extension of time fees.

Respectfully submitted,
BIRCH, STEWART, KOLASCH & BIRCH, LLP

By _____
James M. Slattery
Reg. No. 28,380

1781-224P
Attachments
JMS:CTT:mua:rk

CTT

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MARKED-UP COPY OF AMENDMENTS

In the Specification:

Please **amend the paragraph beginning on page 5, line 9**, as follows:

[Figure 3 is a graphical representation] Figures 3(a)-(c) are graphs of control system signals, showing the tracking ability of an example of a system, such as that of Figure 2, according to the present invention, in which Figure 3(a) shows a signal representing a desired trajectory x_d, Figure 3(b) represents the error signal (x_d - x), and Figure 3(c) represents the control signal provided at the input of the plant and derived by summing the outputs of the PID Controller, the Feed Forward Controller and the Adaptive Feed Forward Controller; and

Please **amend the paragraph beginning on page 5, line 15**, as follows:

[Figure 4 is a graphical representation] Figures 4(a)-(c) are graphs of control system signals, showing the tracking ability of a system without the adaptive feed forward component of the present invention in which Figure [3] 4(a) [again] represents a signal representing a desired trajectory x_d, Figure [3] 4(b) represents the error signal ($x_d - x$), and Figure [3] 4(c) represents the control signal U provided at the input of the plant and derived by summing the outputs of the PID Controller, the Feed Forward.

Please **amend the paragraph beginning on page 9, line 18**, as follows:

The experimental results are shown in [Fig. 3] Figures 3(a)-(c), showing a maximum tracking error of around 5 Tm. To further illustrate the effectiveness of the adaptive dither, the control results without the dither signal are shown in [Fig. 4] Figures 4(a)-(c).

IN THE CLAIMS:

Please **amend claims 1, 2, 3, and 8** as follows:

1. (Amended) A control system for controlling a plant having an operating characteristic which describes the translation of a plant input to a plant output, wherein the plant operating characteristic has a linear component and a non-linear component, the control system comprising:

a feedback control function[,]; and

a feed-forward control function, [such that]

wherein a demand signal is simultaneously applied to respective inputs of the feedback and feed-forward control functions, and respective outputs of the feedback and feed-forward control functions are summed together to generate the plant input, the feed-forward control function having a first component which is a function of a model of the linear component of the plant characteristic, and a second component which is an adaptive function to compensate for the non-linear component of the plant characteristic, [and] the adaptive function being [approximately] substantially modeled on the non-linear component of the plant characteristic and having adaptive laws which vary parameters of the adaptive

function with time such that the adaptive function approaches the non-linear component of the plant characteristic, and

wherein the plant is a permanent magnet linear motor (PMLM).

2. (Amended) The control system of claim **1**, wherein the non-linear component of the plant characteristic is of the form:[-]

$$u_{ripple} = A(x)\sin(\omega x + \emptyset) = A_1(x)\sin(\omega x) + A_2(x)\cos(\omega x),$$

where x is the plant variable,

and where the adaptive function has the form:[-]

$$u_{AFC} = a_1(x(t))\sin(\omega x) + a_2(x(t))\cos(\omega x),$$

where

$$a_1(x(t)) = -ge\sin(\omega x),$$

$$a_2(x(t)) = -ge\sin(\omega x),$$

e is an error signal given by:[-]

$$e = (x_d - x),$$

g is an adaptation gain and is greater than 0, x_d is the desired function of the plant variable and ω is related to 1/period of the non-linear component of the plant characteristic, such that the adaptive feed-forward control function continuously adjusts the parameters a_1 & a_2 in response to the error signal e.

3. (Amended) The system of claim **2**, wherein [the plant is a permanent magnet linear motor (PMLM)] the plant variable x represents an instantaneous position of a translator of the linear motor, the desired function of the plant variable x_d represents the desired trajectory of the translator and the PMLM has a magnetic structure having a pole pitch x_p, such that $\omega = 2\pi / x_p$.

8. (Amended) The system [as claimed in any one] of [claims] claim **1** [to 7], wherein the feedback [controller] control function is a [PID] Proportional/Integral/Derivative (PID) controller [as hereinbefore defined].